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ABSTRACT

A quasi-longitudinal descriptive approach was used to examine mother-infant communication in three groups of three children each: (1) sensory intact infants, (2) visually impaired infants, and (3) hearing impaired infants. Procedures involved initial and final home visits and six monthly play sessions which were videotaped for approximately 20 minutes in the home. Videotapes were analyzed via measures of infant cognitive, communicative, and temperamental qualities (including the Receptive/Expressive Emergent Language Scale, the Symbolic Play Scale, and the Maternal Interview). Maternal utterances were coded and segments of the videotapes were examined and classified according to type of interaction. Findings revealed group differences in frequency of maternal utterance type (including that mothers of hearing impaired and visually impaired children used a greater number of requests for action than requests for information) and in the frequency of exchange-routine types (including that hearing impaired dyads used a greater number of action-based than reference-based routines while visually impaired dyads used an almost equal number of action-based and reference-based routines). Recommendations centered on the use of exchange types for observation and facilitation of communication. (CL)

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MOTHER-INFANT COMMUNICATION: STRATEGIES AND ROUTINES WITH SENSORY INTACT, HEARING IMPAIRED AND VISUALLY IMPAIRED INFANTS

by

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Foreward

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- The mothers and babies, for opening their homes and for teaching us.

EXECUTIVE SUMMARY

Statement of the Problem

Clinicians have observed that sensory impaired infants appear more passive than sensory intact peers, that they do not respond to parental initiations in expected ways, and that they exhibit few behaviors which motivate interaction (Burlingham, 1974; Fraiberg, 1977; Schlesinger & Meadow, 1972). Because these infants may be at risk for reduced parental input, as well as for increased social and sensory deprivation, the facilitation of parent-infant communication is a critical goal of early intervention programs (Connor, 1976; Fraiberg, Smith & Adelson, 1979; Horton, 1974; Rogow, 1983; Walker, 1982).

Purpose of the Study

The purpose of this study was to describe and compare mother-infant communication in three groups: (a) sensory intact infants, (b) visually impaired infants, and (c) hearing impaired infants. The objective of the study was to provide not only descriptive information and quantitative comparisons, but also to translate study findings into specific recommendations for early intervention programs. In order to meet this objective the following research questions were addressed:

1. Are there differences in the frequency of maternal utterance types across the three groups?

2. Are there differences in the frequency of mother-infant exchange types across the three groups?

3. What are the similarities and differences in types of maternal utterances across the three groups?

4. What are the similarities and differences in characteristics of

mother-infant exchanges across the three groups?

Method

A quasi-longitudinal descriptive approach was used to examine mother-infant exchanges in semi-structured play situations. Three dyadic groups were compared: (a) three mothers and their sensory intact infants, (b) three mothers and their hearing impaired infants, and (c) three mothers and their visually impaired infants. Procedures involved initial and final homevisits and six monthly play sessions which were videotaped for approximately 20 minutes in the home.

Hearing impaired infants and their mothers were enrolled in total communication programs in the San Francisco bay area. Visually impaired infants and their mothers were served by the Variety Club Blind Babies Foundation. At the first taping session, hearing impaired infants were between 9 and 16 months of age, visually impaired infants were all 15 months of age and sensory intact infants were 14-16 months of age. The hearing impaired infants had moderate to profound sensorineural losses. The visually impaired infants were legally blind with some residual vision.

Measures of infant cognitive, communicative and temperamental qualities were obtained to facilitate qualitative analysis of the data. The following tools were used: (a) The (REEL) Receptive/Expressive Emergent Language Scale (Bzoch & League, 1970), (b) the Nonverbal Assessment Items (Dunst, 1978), (c) the Maternal Interview (Bates et al., 1979), (d) the Symbolic Play Scale (Westby, 1980); and (e) three or four of the Uzgiris-Hunt (1975) Scales as appropriate. The following four scales were used: (a) Development of means for obtaining desired environmental ends, (b) Development of schemes for relating to objects, (c) Development of vocal imitation, and/or (d)

Development of gestural imitation (Dunst, 1980). Mothers completed the Toddler Temperament Scale (Fullard, McDevitt & Carey, 1983). According to this scale, each group had one "easy" and two "intermediate" (between "easy" and "difficult") infants.

Data Analysis

A combination of ethnographic (Erikson & Shultz, 1981) and psycholinguistic (Corte, Benedict & Klein, 1983) methods were used to select videotaped segments for analysis. For each play session, the first 25 maternal utterances (intelligible and infant-directed) were coded by the principal investigator. This resulted in a total of 150 coded utterances (25 x 6 sessions) for each mother and a total of 450 utterances for each group. The coding scheme was a modification and combination of the pragmatic systems of Folger and Chapman (1978) and Corte, Benedict and Klein (1983). Each maternal utterance was coded as being one of the following: request for information, for action or for permission, label, description, conversational devices, elicited imitation, repetition, proscriptive, a statement of evaluation, or describing maternal or infant feelings, social play, performative play, referential correction, displaced speech and other. The 25 utterance criterion was selected because of the paucity of some mothers' speech during the early sessions with sensory impaired infants. In order to obtain reliability, the project director checked and recoded 15% of the transcripts for each mother-infant pair. Percent agreement was obtained by dividing the number of agreements by the total number of utterances coded. An average of 94% agreement was obtained.

Segment Analysis. In addition to the coding of single maternal utterances, transcripts were divided into cohesive segments based on a series

of maternal utterances about the same object or activity. Segment classifications were determined by a review of available schemes, the focus of the study and an analysis of preliminary data. A modified and expanded version of Shatz's (1982) reference and action conversation cycles was developed. Segments were classified as one of three types of exchanges: (a) imitation or game-based routines, (b) action-based routines, and (c) reference-based routines. Over 94% of the total number of maternal utterance were segmented into one of the three exchange-routine types.

Findings

There was individual variation in the frequency of maternal utterance types and in the frequency of exchange-routine types both within and across groups. Certain trends appear related to the infants' cognitive abilities as well as sensory status. The following is a summary of group differences in the frequency of maternal utterance types:

1. Major differences in maternal utterance types were found between the sensory intact and hearing impaired groups.

2. The visually impaired group was similar to the sensory intact group on some utterance types, and more like the hearing impaired group on others.

3. Mothers of sensory intact infants used an almost equal number of requests for action and requests for information.

4. Mothers of visually impaired infants and mothers of hearing impaired infants used a greater number of requests for action than requests for information.

5. Mothers of hearing impaired infants used a greater number of conversational devices and social play utterances but fewer descriptions, evaluative statements and performative play utterances than mothers of

visually impaired or sensory intact infants.

6. Mothers of visually impaired infants used a greater number of elicited imitation utterances and statements about infant feelings, but fewer repetitions than mothers of hearing impaired or sensory intact infants.

7. Mothers of sensory intact infants used a greater number of displaced speech utterances, requests for information and permission, but fewer labels and proscriptive statements than mothers or visually impaired or hearing impaired infants.

The following is a summary of group differences in the frequency of exchange-routine types:

1. Hearing impaired dyads used a greater number of action-based than referenced-based routines.

2. Visually impaired dyads used an almost equal number of action-based and reference-based routines.

3. Sensory intact dyads used an equal number of action-based and reference-based routines.

4. Hearing impaired dyads used fewer reference-based routines than visually impaired or sensory intact dyads.

5. Visually impaired dyads used fewer action-based routines than hearing impaired or sensory intact dyads.

6. Sensory intact dyads used fewer imitation/game-based routines than hearing impaired or visually impaired dyads.

Conclusions

Mothers in this study were attuned to their infant's communicative abilities and cognitive levels. For the most part, they used a variety of strategies to engage their infants in communicative exchange. These

mothers were a self-selected group who had volunteered to participate in a research study. To a certain extent, their behaviors must have been influenced by the presence of an observer and camera. However, findings support the following conclusions:

1. Differences in the frequency of certain utterance types between mothers of sensory intact infants and mothers of hearing impaired infants reflect the impact of an infant's hearing loss and the elementary sign language level of the hearing impaired dyads.

2. Similarities in the frequency of certain utterance types between mothers of visually impaired infants and mothers of hearing impaired infants reflect maternal strategies in communication with a preverbal partner.

3. Similarities in the frequency of certain utterance types between mothers of visually impaired infants and mothers of sensory intact infants reflect an emphasis on functional use of the visually impaired infants' residual vision.

4. Analysis of exchange-routine types support the findings for single utterance types among the three dyadic groups.

5. In contrast to single maternal utterances, an examination of exchange-routine types provides a richer and more accurate description of mother-infant communication, as well as a means to evaluate the infant's participation.

6. The majority of mother-infant communication in play situations may be classified as one of three types of exchange-routines: imitation/game-based, action-based or reference-based.

7. There is a tendency for imitation/game-based routines to be used mainly with infants at sensorimotor Stages III and IV.

8. There is a tendency for action-based routines to be used mainly with

infants at sensorimotor Stages IV and V.

9. There is a tendency for reference-based routines to be used mainly with infants at sensorimotor Stages V and VI.

Exchange routine types may be characterized by the following formats which are identified from the mother's perspective:

1. "You do-I do" infant-initiated or "I do-you do" mother-initiated imitation/game-based routines.

2. "I request action-You do" or mother-initiated and "You request action-I do" or infant-initiated action-based routines.

3. "I ask-You tell" or mother-initiated and "You ask-I tell or infant-initiated referenced-based routines.

Recommendations

This study was an initial step in establishing a data base from which to develop intervention procedures to optimize parental communication with sensory impaired infants. Given the limitations of the study, the proposed framework of exchange-routines is tentative at best. However, the following recommendations are based on study findings which are consistent with the literature and the theoretical basis of the study.

It is recommended that the proposed exchange-routine framework be used to observe mother communication with sensory impaired infants. These observations will determine: (a) types of routines used, (b) usefulness of a particular routine for an individual infant, (c) strategies used to maintain the routine, (d) strategies needed to maintain and expand the routine, and (e) idicsyncratic dyadic strategies. In addition, observations will provide a basis for further modification or expansion and/or validation of the proposed framework.

It is recommended that imitation/game-base routines be used as an initial step in communicating with the unresponsive infant. The infant's original vocalization and/or action should be expanded to incorporate new actions, objects, vocalizations and words. An expansion of the imitation-based routine will discourage the development of "parrot-like", meaningless exchanges. In addition, object use will provide a definite structure for imitation/game-based routines and will facilitate transition to action-based routines.

It is recommended that action-based routines be used to facilitate communication with a preverbal infant. These routines require no verbal behavior but they elicit turn-taking and joint reference behaviors. A scaffold of maternal prompts should be used to facilitate the infant's transition to reference-based routines.

Study findings demonstrate that mothers of sensory intact and sensory impaired infants develop adaptive strategies to fit the infant's sensory status, communicative and cognitive abilities. Mothers in this study seem to fine tune exchange-routines as a means of communicating with an immature partner. These routines seem to be enjoyable, repetitive and predictable. Such features encourage joint reference, facilitate turn-taking and promote infant anticipation of a sequence of events. The literature suggests that communication develops through reciprocal interactions with significant others. If this is so, then well developed exchange-routines represent an invaluable means of establishing communication with a preverbal infant. Early intervention programs should therefore focus on developing individualized exchange-routines in order to optimize parent-infant communication.

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CHAPTER I

INTRODUCTION

Statement of the Problem

A congenital sensory impairment complicates the intricate process of parent-infant communication. Behaviors which elicit auditory and visual attention are common currency in early parent-infant exchanges. However, the visually impaired or hearing impaired infant has limited access to the communicative intent of such behaviors as gaze, facial expression, vocalizations and gesture.

Clinicians have observed that sensory impaired infants appear more passive than sensory intact peers, that they do not respond to parental initiations in expected ways, and that they exhibit few behaviors which motivate interaction (Burlingham, 1974; Fraiberg, 1977; Schlesinger & Meadow, 1972). Because these infants may be at risk for reduced parental input, as well as for increased social and sensory deprivation, the facilitation of parent-infant communication is a critical goal of early intervention programs (Connor, 1976; Fraiberg, Smith & Adelson, 1979; Horton, 1974; Rogow, 1983; Walker, 1982).

At present there is relatively little research on which to base intervention strategies or by which to evaluate particular parent-infant exchanges. This study is an initial step in developing a data base from which to formulate evaluation and intervention procedures which will optimize early exchanges between parents and their sensory impaired infants.

Review of the Literature

Sensory intact infants. This study was guided by the social-

interactional and pragmatic approaches to the development of communication in sensory intact infants. Researchers have argued that language emerges from familiar social routines and communicative functions which have been developed within the context of conversation-like exchanges with the primary caregiver, usually the mother (Bates, Bretherton & Beeghley-Smith, 1982; Bates, Bengini, Bretherton, Camaioni & Volterra, 1979; Bruner, 1977; Bullowa, 1976; Dore, 1975; Halliday, 1975; Freedle & Lewis, 1977; Snow, 1977; Trevarthen & Hubley, 1978). According to Bruner (1977) early social routines expose the infant to the basic rule structures of language and provide critical opportunities for turn-taking and commenting on a shared topic. This theoretical perspective has been recognized as having implications for language development programs in special education (Mclean & Snyder-Mclean, 1978; Rogers-Warren & Warren, 1984) but the path from research to practice remains relatively uncharted.

Visually impaired infants. Severe visual impairment restricts the infant's access to and use of nonvocal communication means. Parents of visually impaired infants must decipher subtle signals and develop alternative ways to establish joint attention and nonverbal reference. These infants have been characterized as fussier and less socially responsive than sighted peers in mother-infant play situations (Rogers & Puchalski, 1984). The common strategies of game routines and imitation rituals have been frequently observed in mother- visually impaired infant exchanges (Als, Tronick & Brazelton, 1980; Fraiberg, 1977; Kekelis, 1981; Urwin, 1978). It is of interest to note that these mothers use strategies which are usually observed in exchanges with younger sensory intact infants. Tactile/physical games and frequent repetitions of familiar words appear to attract and elicit the visually impaired infant's participation in the social routine. Researchers have suggested that the language development of visually impaired infants may be

facilitated by certain preverbal exchanges and game routines (Fraiberg, 1977; Rowland, 1980; Rogow, 1983; Urwin, 1978).

Hearing impaired infants. The invisibility of a hearing loss has hampered the immediate identification of hearing impaired infants born to hearing parents. As a result, few studies have examined the communication strategies of these dyads. Studies which are available represent diverse research interests and focus mainly on comparisons between total communication and oral programs or between hearing and hearing impaired parents of hearing impaired infants. There is some evidence that hearing mothers (of both oral and total communication programs) tend to dominate exchanges, that they use less speech than mothers with hearing infants (Ling & Ling, 1976; Wedell-Monnig & Lumley, 1980), and that they combine vocal, visual and physical modes of communication to elicit infant responses (Blennerhassett, 1981; Green, Greenstein, McConville & Stellini, 1975). In contrast, similarities have been reported in preverbal exchanges between a hearing and a hearing impaired infant and their mothers (Nienhuys & Tikotin, 1983), as well as between the conversational styles of mothers with sensory intact infants (Snow, 1977) and mothers with hearing impaired infants in oral programs (Anderson, 1979; Bremer, 1982).

This review of the literature suggests that mother-infant exchanges play a significant role in the infant's development of communication. In addition, there is a recognized need for detailed descriptions of mother-sensory impaired infant exchanges (van der Geest, 1983). Such descriptions are essential for determining how a sensory intact parent compensates for an infant's sensory loss in an adaptive way. At present the translation of research findings into applied settings remains problematical. However, mother-infant exchanges may be optimized by use of effective maternal strategies to attract and engage the sensory impaired infant in enjoyable

reciprocal routines.

Purpose of the Study

The purpose of this study was to describe and compare mother-infant communication in three groups: (a) sensory intact infants, (b) visually impaired infants, and (c) hearing impaired infants. The objective of the study was to provide not only descriptive information and quantitative comparisons, but also to translate study findings into specific recommendations for early intervention programs. In order to meet this objective the following research questions were addressed:

1. Are there differences in the frequency of maternal utterance types across the three groups?

2. Are there differences in the frequency of mother-infant exchange types across the three groups?

3. What are the similarities and differences in types of maternal utterances across the three groups?

4. What are the similarities and differences in characteristics of mother-infant exchanges across the three groups?

CHAPTER II

METHODS OF THE STUDY

A quasi-longitudinal descriptive approach was used to examine mother-infant exchanges in semi-structured play situations. A "play session" protocol was selected because the primary objective of the study was to identify adaptive strategies which could be translated into programming procedures. Three dyadic groups were compared: (a) three mothers and their sensory intact infants, (b) three mothers and their hearing impaired infants, and (c) three mothers and their visually impaired infants.

Sample

Sensory impaired infants were limited to those whose major diagnosis was a severe visual or hearing impairment. The following criteria were used in selection of the infants for each of the three groups:

1. Sight and hearing within normal ranges.
2. A congenital visual impairment, diagnosed as legally blind, with no more than a minimum amount of residual vision.
3. A congenital impairment with at least an 80 dB loss (unaided) in the better ear. (This criterion was met by all three hearing impaired infants when they entered the study. However, towards the end of the study, a second hearing evaluation of one infant diagnosed a moderate loss).

The following criteria were used in selection of all subjects:

1. In overall good health.
2. At the preverbal or early verbal stage of language development.
3. Between 9 and 18 months of age when entering the study.

4. The mother was primary caregiver.

5. The parents are sensory intact.

6. English was the predominant language spoken in the home.

7. Mother and infant usually engaged in play activities.

Hearing impaired infants and their mothers (Dyads H1, H2 & H3) were recruited from the infant programs in the San Francisco bay area. These mothers ranged from 19 to 26 years of age with 11 to 14 years of education. These dyads had been enrolled in total communication infant programs for a period of one to six months when they entered the study, and were served mainly by regular home visits from teachers of the infant programs.

Visually impaired infants and their mothers (Dyads V1, V2 & V3) were contacted through referrals from the Variety Club Blind Babies Foundation serving Northern California. These families had been visited regularly by a home counselor and had been enrolled in the Variety club program for a period of 3 to 15 months when they entered the study. In addition, one dyad also received home visits from a teacher of the local infant program for the visually impaired. Mothers of visually impaired infants ranged in age from 19 to 26 years of age and had between 12 and 14 years of education.

Sensory intact infants and their mothers (Dyads S1, S2 & S3) were recruited by acquaintances of the principal investigator. These mothers ranged in age from 26 to 36 years with 14 to 18 years of education. Table 1 contains infant subject descriptions by age, sex, diagnosis and sensory status.

Data Collection

Procedures involved initial and final homevisits and six monthly play sessions which were videotaped for approximately 20 minutes in the home.

Table 1

Description of Infants by Age, Sex, Diagnosis, Sensory Status and Prematurity

Group	Adjusted Age/months[a]	Sex	Diagnosis	Sensory Status	Prematurity
Hearing Impaired					
H1	9-14	F	Sensorineural loss	Moderate loss	Yes
H2	14-19	F	Sensorineural loss	Severe-Profound loss	No
H3	16-21	M	Sensorineural loss	Severe-Profound loss	No
Visually Impaired					
V1	15-20	F	Optic Nerve Hypoplasia	Partially Sighted	No
V2	15-20	M	Retrolental Fibroplasia (RLF)	Partially Sighted	Yes
V3	15-20	F	Aniridia/ Aphakia	Partially Sighted	No
Sensory Intact					
S1	14-19	M	-	-	-
S2	14-20[b]	F	-	-	-
S3	16-21	F	-	-	-

[a] Ages at first and last taping sessions.

[b] S2 had one 6 week instead of a 4 week lapse between sessions because of illness.

- not applicable

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Initial home visit (s). During this pretaping visit, several measures of the infant's cognitive and communicative levels were obtained. Certain measures were selected because of their reported relationship to early communication in the literature. In particular, the infant variables of cognitive abilities (Bates et al., 1979; Sugarman-Bell, 1978) and temperamental attributes (Ramey, Beckman-Bell & Gowen, 1980; Thomas & Chess, 1977) may influence both the quality and quantity of mother-infant communication. A combination of researcher interaction with the infant, observation and maternal report was used to complete the following measures: (a) The (REEL) Receptive/Expressive Emergent Language Scale (Bzoch & League, 1970), (b) the Nonverbal Assessment Items (Dunst, 1978), (c) the Maternal Interview (Bates et al., 1979), (d) the Symbolic Play Scale (Westby, 1980); and (e) three or four of the Uzgiris-Hunt (1975) Scales as appropriate. The following four scales were used: (a) Development of means for obtaining desired environmental ends, (b) Development of schemes for relating to objects, (c) Development of vocal imitation, and/or (d) Development of gestural imitation (Dunst, 1980).

The primary purpose of these infant measures was to supplement observational data and to determine any influence of infant cognitive abilities on the quality and quantity of mother-infant communication. Mothers were asked to complete the Toddler Temperament Scale (Fullard, McDevitt & Carey, 1983) at their earliest convenience and return it at the next taping session. The purpose of this measure was to ensure temperamental similarity among groups and to isolate any "difficult" infants. Results indicated that each group had one "easy" (H1, V3 & S2) and two "intermediate" (H2, H3, V1, V2, S1 & S3) infants. "Intermediate" infants fell between the "easy" and "difficult" diagnostic clusters. During the pretaping home visit, the mother was encouraged to engage her infant in favorite play activities in addition to

describing them. One or two pretaping visits were made depending on the families' schedule. All visits ranged from 1 to 3 hours in duration.

Play sessions. Each mother was asked to play with her infant as she would when she had some free time. Mothers and infants could use their own as well as a number of toys provided by the researcher. Toys were selected for attributes which would appeal to both visually impaired and hearing impaired infants, which would encourage mother-infant communication, and were furnished to promote consistency in the play settings across homes (See Appendix A). Sessions were recorded with a video camera and a portable video cassette recorder. The researcher would first visit with mother and infant upon arrival to the home. Most infants became interested in the toy basket provided by the researcher or mothers begin examining the toys. At that point, the video equipment would be set up and taping would begin after mother and infant had become involved in playing together.

The camera was hand held at an unobstrusive distance from the mother-infant pair. Taping was continuous except for interruptions caused by phone calls, door bells, other family members engaging in lengthy conversation or when the infant became fussy or left the scene. An average of 20 minutes was recorded for each play session.

Final home visit. Pre-taping cognitive and communicative measures were repeated. Mothers viewed segments of the taped play sessions across the six month period and were asked to comment on their own and their infants's behavior. All mothers reported feeling somewhat self conscious during the first taping session, but by the second or third session they felt quite at ease. Mothers made unsolicited comments on how much they had enjoyed the project and the play time with their infants. Families requested and received a copy of their videotaped play sessions as a token of appreciation for

involvement in the study.

Data Analysis

A combination of ethnographic (Erikson & Shultz, 1981) and psycholinguistic (Corte, Benedict & Klein, 1983) methods were used to select videotape segments for detailed analysis. The following procedures were used for data reduction:

Level 1. Each play session tape was viewed and notes were taken as the tape ran continuously. These notes indexed the types of mother-infant activities contained on the tape.

Level 2. After tapes were indexed, they were examined for the longest continuous segments of mother-infant play. This decision for selection was based on the focus of the study to characterize optimal mother-infant exchanges. It was reasoned that these continuous segments would most likely represent mutually enjoyable, reciprocal routines. Approximately 5 minutes of these "optimal" segments were selected for further analysis.

Level 3. Each of the selected 5 minute segments were recorded on two copy tapes, resulting in a total of 30 minutes for each mother-infant pair across sessions. Transcripts were made of these tapes using a modified version of Ochs (1979). Maternal utterances were transcribed in regular orthography and infant utterances were transcribed using the International Phonetic Alphabet.

Level 4. For each 5 minute segment, the first 25 utterances (intelligible and infant-directed) were coded by the principal investigator using a scheme to reflect the underlying communicative functions of these utterances. This resulted in a total coding of 150 utterances (25 x 6 sessions) for each mother and 450 utterances for each dyadic group. The coding scheme was determined by the focus of study, review of existing systems and a preliminary examination

of the data. A modification and combination of the pragmatic system of Folger and Chapman (1978) and that of Corte, Benedict and Klein (1983) was adopted. (See Appendix B). Each maternal utterance was coded as being one of the 17 following types: request for information, for action or for permission, label, description, conversational devices, elicited imitation, repetition, proscriptive, a statement of evaluation, or describing maternal or infant feelings, social play, performative play, referential correction, displaced speech and other. The 25 utterance criterion was selected because of the paucity of some mothers' speech during the early sessions with sensory impaired infants. Coding was accomplished while viewing tapes and examining transcripts so that context, intonation, tone of voice and nonverbal behaviors could be used in coding decisions.

In order to obtain reliability, the project director checked and recoded 15% of the transcripts for each mother-infant pair, using the second copy tape. Percent agreement was obtained by dividing the number of agreements by the total number of utterances coded. An average of 94% agreement was obtained. It is of interest to note that almost half of the disagreements occurred in a single case of a particular mother of a hearing impaired infant. This mother did not have well developed communicative routines, perhaps making it more difficult for both coders to determine her communicative intent.

Segment Analysis. In addition to the coding of single maternal utterances, transcripts were divided into cohesive segments based on a series of maternal utterances about the same object or activity. Segment classifications were determined by a review of available schemes, the focus of the study and an analysis of preliminary data. A modified and expanded version of Shatz's (1982) reference and action cycles was developed. (See Appendix C). Segments were classified as one of three types of exchanges:

(a) imitation or game-based routines, (b) action-based routines, and (c) reference-based routines. Over 94% of the total number of maternal utterance were segmented into one of the three exchange-routine types. A few utterances were excluded as unclassifiable within routine type criteria. These utterances were mainly fillers, unclear transitions to other routines, interrupted or false starts to routines or single utterances in response to infant behavior. Table 2 displays the percentage of single utterances classified under the exchange-routine types. The sensory intact dyads had 98.9% of single maternal utterances classified in the routine categories. The visually impaired dyads had 93.1% and the hearing impaired dyads had 92% of their total utterances classified within the three routine types.

Tabulation of Data. Two sets of data were calculated and tabulated:

1. The absolute frequency and percent of the total number of maternal utterance types using the single utterance coding categories.

2. The absolute frequency and percent of the total number of exchange-routine types using a classification scheme for transcript segments.

These data were obtained for within subject across session, within group and across group comparisons.

Table 2

Total Number and Percentage of Maternal Utterances Classified in Exchange-Routine Types

Group	Dyad 1	2	3	Total
Hearing Impaired	139 (92.7%)	138 (92%)	137 (91.3%)	414 (92%)
Visually Impaired	127 (84.7%)	147 (98%)	145 (96.7%)	419 (93.1%)
Sensory Intact	149 (99.3%)	148 (98.7%)	148 (98.7%)	446 (98.9%)

Note. Maximum number of utterances for each dyad = 150.

Maximum number of utterances for each group = 450.

CHAPTER III

FINDINGS

Quantitative Differences

Differences in Maternal Utterances Types

There was individual variation in the frequency of maternal utterance types and in the frequency of exchange-routine types both within and across groups. Certain trends appear related to the infants' cognitive abilities as well as sensory status. The major findings of this study are displayed in Tables 3 and 4. The following is a summary of group differences in the frequency of maternal utterance types as shown in Table 3:

1. Major differences in maternal utterance types were found between the sensory intact and hearing impaired groups.

2. The visually impaired groups was similar to the sensory intact group on some utterance types, and more like the hearing impaired group on others.

3. Mothers of sensory intact infants used an almost equal number of requests for action (107) and requests for information (105).

4. Mothers of visually impaired infants used a greater number of requests for action (120) than requests for information (65).

5. Mothers of hearing impaired infants used a greater number of requests for action (130) than requests for information (62).

6. Mothers of hearing impaired infants used a greater number of conversational devices (87) than mothers of visually impaired (47) or sensory intact (42) infants.

7. Mothers of hearing impaired infants used a greater number of social play utterances (13) than mothers of visually impaired (4) or sensory intact (1) infants.

Table 3

Total Number and Percentage of Maternal Utterances for 17 Functional Categories for Each Dyadic Group

Function	Dyadic Group: Hearing Impaired	Visually Impaired	Sensory Intact
Request for Action (RA)	130 (28.9%)	120 (26.7%)	107 (23.8%)
Request for Information (RI)	62 (13.8%)	65 (14.4%)	105 (23.3%)
Label (L)	42 (9.3%)	44 (9.8%)	24 (5.3%)
Description (D)	53 (11.8%)	73 (16.2%)	78 (17.3%)
Conversational Device (CD)	87 (19.3%)	47 (10.4%)	42 (9.3%)
Elicited Imitation (EI)	3 (0.7%)	22 (4.8%)	-
Repetition (R)	14 (3.1%)	8 (1.8%)	16 (3.5%)
Social Play (SP)	13 (2.9%)	4 (0.9%)	1 (0.2%)
Performative Play (PP)	-	6 (1.3%)	7 (1.5%)
Request for Permission (RP)	3 (0.7%)	2 (0.4%)	16 (3.5%)
Referential Correction (RC)	2 (0.4%)	1 (0.2%)	1 (0.2%)
Proscriptive (P)	11 (2.4%)	6 (1.3%)	2 (0.4%)
Statement: Evaluation (SE)	12 (2.6%)	20 (4.4%)	28 (6.2%)
Statement: Infant Feelings (SIF)	7 (1.5%)	18 (4%)	12 (2.7%)
Statement: Maternal Feelings (SMF)	-	2 (0.4%)	2 (0.4%)
Displaced Speech (DS)	-	1 (0.2%)	7 (1.5%)
Other (O)	11 (2.4%)	11 (2.4%)	9 (2%)
Total number of utterances	450	450	450

Note. - No occurrence

8. Mothers of hearing impaired infants used fewer descriptions (53) than mothers of visually impaired (73) or sensory intact (78) infants.

9. Mothers of hearing impaired infants used fewer (0) performative play utterances than mothers of visually impaired (6) or sensory intact (7) infants.

10. Mothers of hearing impaired infants used fewer evaluative statements (12) than mothers of visually impaired (20) or sensory intact (28) infants.

11. Mothers of visually impaired infants used a greater number of elicited imitation utterances (22) than mothers of hearing impaired (3) or sensory intact (0) infants.

12. Mothers of visually impaired infants used a greater number of statements about infant feelings (18) than mothers of hearing impaired (7) or sensory intact (12) infants.

13. Mothers of visually impaired infants used fewer repetitions (8) than mothers of hearing impaired (14) or sensory intact (16) infants.

14. Mothers of sensory intact infants used a greater number of requests for information (105) than mothers of hearing impaired (62) or visually impaired (65) infants.

15. Mothers of sensory intact infants used a greater number of requests for permission (16) than mothers of hearing impaired (3) or visually impaired (2) infants.

16. Mothers of sensory intact infants used a greater number of displaced speech utterances (7) than mothers of hearing impaired (0) or visually impaired (1) infants.

17. Mothers of sensory intact infants used fewer labels (24) than mothers of hearing impaired (42) or visually impaired (44) infants.

18. Mothers of sensory intact infants used fewer proscriptive statements (2) than mothers of hearing impaired (11) or visually impaired (6) infants.

Differences in Exchange-Routine Types

As shown in Table 4, the following is a summary of group differences in the frequency of exchange-routine types:

1. Hearing impaired dyads used a greater number of action- based (57) than reference-based (35) routines.

2. Visually impaired dyads used an almost equal number of action-based (43) and reference-based (44) routines.

3. Sensory intact dyads used an equal number or action- based (59) and reference-based (59) routines.

4. Hearing impaired dyads used fewer reference-based routines (35) than visually impaired (44) or sensory intact (59) dyads.

5. Visually impaired dyads used fewer action-based routines (43) than hearing impaired (57) or sensory intact (59) dyads.

6. Sensory intact dyads used fewer imitation/game-based routines (2) than hearing impaired (25) or visually impaired (14) dyads.

Table 4

Total Number and Percentage of Exchange-Routine Types

Group Dyad	Exchange-Routines: Imitation/ game-based	Action-based	Reference-based	Dyad Total
Hearing Impaired				
H1	20 (57.1%)	10 (28.6%)	5 (14.3%)	35
H2	1 (2.3%)	21 (48.4%)	21 (48.8%)	43
H3	4 (10.2%)	26 (66.7%)	9 (23.1%)	39
Totals	25 (21.4%)	57 (48.7%)	35 (29.9%)	117
Visually Impaired				
V1	14 (53.8%)	12 (46.2%)	-	26
V2	-	8 (22.9%)	27 (77.1%)	35
V3	-	23 (57.5%)	17 (42.5%)	40
Totals	14 (13.9%)	43 (42.6%)	44 (43.6%)	101
Sensory Intact				
S1	1 (2.9%)	26 (76.5%)	7 (20.6%)	34
S2	1 (2.2%)	23 (50%)	22 (47.8%)	46
S3	-	10 (25%)	30 (75%)	40
Totals	2 (1.7%)	59 (49.2%)	59 (49.2%)	120

Discussion

As shown in Table 3, the visually impaired dyads used a greater number of requests for action (120) than requests for information (65). On the other hand, Table 4 shows that visually impaired dyads used an almost equal number of action-based (43) and reference-based (44) routines. At first, these findings seemed contradictory. However, an examination of the transcripts and criteria for segmenting exchange-routines resolved this disparity. Mothers of visually impaired infants repeat their requests for action within a single action-based routine. Mothers of all three groups tended to repeat requests for action. However, this strategy may be particularly useful for an infant with impaired vision. On the other hand, requests for information may not need to be repeated for an infant who can hear.

As shown in Table 3, mothers of hearing impaired infants used a greater number of requests for action (130) than requests for information (62). This ratio is similar to the ratio found in visually impaired dyads. However, as shown in Table 4, mothers of hearing impaired infants used a greater number of action-based routines (57) than reference-based (35) routines. This ratio differs from the almost equal number found in visually impaired dyads. These data suggest that mothers of hearing impaired infants repeated requests for information more frequently than requests for action, whereas the opposite was the case for mothers of visually impaired infants.

These findings suggest that an examination of exchange-routines, rather than single maternal utterances will provide a more complete description of mother-infant communication. Exchange-routines reveal maternal strategies to engage the infant in communication and also incorporate infant responses.

Tables 3 and 4 show that the visually impaired dyads were similar to the sensory intact dyads in frequency of action-based to reference-based routines

and in the use of descriptions, conversational devices, performative play and statement types of utterances. These similarities may be due to sample characteristics. All three visually impaired infants had some residual vision which they were using remarkably well. Their mothers emphasized looking behaviors. On the other hand, as shown in Tables 3 and 4, the visually impaired dyads were similar to the hearing impaired dyads in the use of labels, requests for permission, and imitation/game-based routines. In comparison to the sensory intact infants, similarities in findings with hearing impaired and visually impaired infants suggest that the sensory impaired infants were alike in terms of communicative and cognitive abilities.

Differences between the hearing impaired dyads and the two other groups reflect the impact of an infant's hearing loss. As shown in Table 3, mothers of hearing impaired infants used a large number of conversational devices to maintain the exchange. These mothers were motivated to communicate in a conversational way but their sign skills could not maintain a conversation, so they resorted to the use of prompts, fillers, acknowledgements and idiosyncratic social utterances. This novice sign level is reflected also in the lack of performative play, displaced speech and maternal feeling utterances as well as in the low number of descriptions.

Statistical Analyses

The Chi-Square goodness of fit was used to determine if any of the differences in use of utterance or exchange-routine types were statistically significant among the three dyadic groups. Table 5 displays the Chi-square analyses for the 5 main types of maternal utterances: request for action (RA), request for information (RI), label (L), description (D) and conversational device (CD). The following differences were statistically

significant:

1. Mothers of sensory intact infants used significantly more requests for information ($p<.01$) and fewer labels ($p<.01$) than mothers of visually impaired infants.

2. Mothers of sensory intact infants used significantly more requests for information ($p<.01$) and descriptions ($p<.05$) but fewer labels ($p<.05$) than mothers of hearing impaired infants.

3. Mothers of hearing impaired infants used significantly more conversational devices than mothers of sensory intact ($p<.001$) or mothers of visually impaired ($p<.01$) infants.

These findings reflect the impact of an infant's sensory loss on early communication and maternal strategies to establish and maintain communication with an immature partner.

In contrast, there were no significant differences between the mothers of visually impaired and sensory intact infants in the use of conversational devices or descriptions. There were no significant differences between the visually impaired and hearing impaired dyads in the use of requests for information, labels and descriptions. This finding may reflect similarities in the communicative and cognitive levels of these visually impaired and hearing impaired infants. There were no significant differences among the three dyadic groups in the use of requests for action. This finding may reflect the preverbal characteristic of the infant subjects and a common maternal strategy to elicit infant participation in play activities.

Table 5
Chi-Square Analysis For Maternal Utterance Types

For Type of Utterance: Request for Action (RA)			
Groups Compared	Frequencies	Chi-Square	Significance
SI	107	.634	n.s.
VI	120		
SI	107	2.042	n.s.
HI	130		
VI	120	.324	n.s.
HI	130		

For Type of Utterance: Request for Information (RI)			
Groups Compared	Frequencies	Chi-Square	Significance
SI	105	8.947	P < .01
VI	65		
SI	105	10.563	P < .01
HI	62		
VI	65	.031	n.s.
HI	62		

For Type of Utterance: Label (L)			
Groups Compared	Frequencies	Chi-Square	Significance
SI	24	5.309	P < .05
VI	44		
SI	24	4.379	P < .05
HI	42		
VI	44	.012	n.s.
HI	42		

For Type of Utterance: Description (D)			
Groups Compared	Frequencies	Chi-Square	Significance
SI	78	.106	n.s.
VI	73		
SI	78	4.397	P < .05
HI	53		
VI	73	2.865	n.s.
HI	53		

For Type of Utterance: Conversational Devices (CD)			
Groups Compared	Frequencies	Chi-Square	Significance
SI	42	.180	n.s.
VI	47		
SI	42	15.008	P < .001
HI	87		
VI	47	11.351	P < .01
HI	87		

Table 6 displays the results of the Chi-Square analyses for action-based (AB) and reference-based (RB) routines. These findings are consistent with the analyses of single utterance types. Imitation/game-based differences were not subjected to statistical analysis, because in each group, there was a single dyad which used that routine most frequently. A single comparison was statistically significant. Sensory intact dyads used significantly more RB routines($p < .05$)than hearing impaired dyads. This finding is not surprising given the novice sign level of the hearing impaired dyads and their short period of enrollment in intervention programs. In contrast, visually impaired dyads did not differ significantly from sensory intact or hearing impaired dyads in the use of RB routines. There were no significant differences among the three dyadic groups in the use of AB routines. This finding reflects the preverbal characteristic of infant subjects and identifies a common maternal strategy for eliciting infant communication.

Table 6

Chi-Square Analysis For Exchange-Routine Types

For Routines for Category: Action-based (AB)

Groups Compared	Frequencies	Chi-Square	Significance
SI	59	2.206	n.s.
VI	43		
SI	59	.000	n.s.
HI	57		
VI	43	1.690	n.s.
HI	57		

For Routines for Category: Reference-based (RB)

Groups Compared	Frequencies	Chi-Square	Significance
SI	59	1.903	n.s.
VI	44		
SI	59	5.628	$P < .05$
HI	35		
VI	44	.810	n.s.
HI	35		

Within Group Differences

The following discussion is based on Tables 4 and 7 which show the frequency of exchange-routine types (Table 4) and of single maternal utterance types (Table 7).

Hearing Impaired Dyads. Mother H1 communicated with her infant by means of idiosyncratic conversational devices and imitation/game-based routines. She developed elaborate greeting rituals with toys to attract and engage the infant's attention. This strategy is reflected in a high percentage (57.14%) of imitation/game-based routines, and is appropriate for an infant who was 9 months old at the first play session. This dyad developed imitative routines with different toys, for example, banging sound toys, rolling cars and feeding a doll. Over the six month period, infant H1 changed from indiscriminate banging and mouthing of objects to symbolic play and functional use of objects. At the end of the study, she used showing, offering, pointing, vocalization and a few signs to comment and to make requests.

Mother H2 had less developed exchange-routines in comparison to other mothers. She would wait for her infant to initiate a routine. This tendency may explain the almost equal percentage of action-based and reference-based routines, and a low percentage (2.3%) of imitation/game-based routines. These findings contrast with the higher percentage of action-based and imitation/based routines of the two other hearing impaired dyads. Mother H2 used a higher percentage of RA (26.7%) than RI (18.7%). This finding suggests RI were not repeated, whereas RA were repeated. An examination of transcripts revealed that Mother H2 used RI in a rhetorical manner and provided answers to her own questions. During latter sessions, this mother developed a more predictable response routine to her infant's initiations. It is fortunate that Infant H2 had a well developed preverbal communication system at the age

of 14 months. From the first session, she used pointing, showing, offering and vocalizations and a few signs to comment and to make requests. Throughout the six month period, she displayed functional object and symbolic play.

Mother H3 had a predictable way of structuring action-based routines. She would elicit her infant's attention, demonstrate the activity and encourage participation through the use of gestural prompts. This dyad used a high percentage of action-based routines (66.7%). This mother developed elaborate imitation/game-based routines with objects and encouraged symbolic play routines. These findings on exchange-routines are consistent with the data on maternal utterance types. Infant H3 was similar to Infant H2 in terms of communicative skills. He had a few more signs since he had been identified as hearing impaired several months earlier, and he was 2 months older than Infant H2 at the beginning of the study. In contrast to Mother H2, Mother H3 had well developed exchange-routines and initiated routines. It is of interest to note that all three dyads developed symbolic play routines despite their limited sign repertoire. The use of symbolic play routines may be a means to facilitate communication with a hearing impaired infant.

Table 7

Total Number and Percentage of Maternal Utterances for Nine Functional Categories for Each Dyad

	Group Dyad								
Function	H1	H2	H3	V1	V2	V3	S1	S2	S3
RA	22 (14.7%)	40 (26.7%)	68 (45.3%)	35 (23.3%)	24 (16%.)	61 (40.7%)	46 (30.7%)	42 (28%)	19 (12.7%)
RI	15 (10%)	28 (18.7%)	19 (12.7%)	8 (5.3%)	33 (22%)	24 (16%)	12 (8%)	40 (26.7%)	53 (35.3%)
L	12 (8%)	22 (14.6%)	8 (5.3%)	3 (2%)	29 (19.3%)	12 (8%)	10 (6.7%)	9 (6%)	5 (3.3%)
D	16 (10.7%)	27 (18%)	10 (6.7%)	15 (10%)	37 (24.7%)	21 (14%)	24 (16%)	25 (16.6%)	29 (19.3%)
CD	48 (32%)	17 (11.3%)	22 (14.7%)	28 (18.7%)	8 (5.3%)	11 (7.3%)	21 (14%)	8 (5.3%)	13 (8.7%)
EI	1 (0.7%)	1 (0.7%)	1 (0.7%)	22 (14.7%)	-	-	-	-	-
R	10 (6.7%)	2 (1.3%)	2 (1.3%)	1 (0.7%)	1 (0.7%)	6 (4%)	3 (2%)	6 (4%)	7 (4.7%)
SP	9 (6%)	2 (1.3%)	2 (1.3%)	3 (2%)	1 (0.7%)	- -	- -	1 (0.7%)	- -
PP	- -	- -	- -	2 (1.3%)	4 (2.7%)	- -	7 (4.7%)	- -	- -

Note. Maximum number of utterances for each dyad = 150.

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Visually Impaired Dyads. Mother V1 used a large percentage of imitation/game-based routines (53.8%) to engage her infant. Infant V1 was most responsive to this type of routine. She rejected action-based routines which were accompanied by physical guidance, unless Mother V1 incorporated a vocal play component. This mother did not use any reference-based routines. In contrast she used a small percentage of RI (5.3%). An examination of transcripts explains this disparity. Mother V1 had not developed reference-based routines and her infant did not respond to single utterances which requested information. In early sessions, Infant V1 seemed similar to Infant H1 on object use. However, Infant V1 was 15 months old at the beginning of the study and she did not progress beyond banging, rolling and throwing objects over the six months. She responded to peek-a-boo and imitation/game-based routines but did not initiate them. This infant had an imitative vocabulary of several word approximations but she was not observed using them in a meaningful way, although her mother reported otherwise. Mother V1 encouraged vocal imitation/game-based routines by using EI utterances (14.7%). This mother used a high percentage of CDs (18.7%) to maintain communication with a relatively immature partner.

Mother V2 used a book-reading routine in 4 out of 6 play sessions. This mother-infant preference is reflected in the unusually high percentage of reference-based routines (77.1%) for a preverbal infant. The predictable structure of a book-reading routine accounts for the low use of CD (5.3%). Infant V2 was 15 months old (corrected for prematurity) at the first session. By the following month, looking at books has become a favorite activity. His face was almost on the page in order to see the pictures. During the six month period, this infant developed touching, reaching, giving, taking and vocalizations to comment and make requests. However, he remained essentially

preverbal in communication. By the end of the study, this dyad engaged in some symbolic play routines, for example, doll play and feeding each other. This dyad should engage in more action-based and reference-based routines with objects to facilitate the infant's verbal development.

Mother V3 had a well defined and predictable way of communicating with her infant. Her action-based routines were clearly marked with demonstration, prompts and evaluative statements. The ratios of RA to RI, and of action-based to reference-based routines were in the same direction as those of Dyads H3 and S1. At the first session, Infant V3 was 15 months old, she had several imitative word approximations which she used to comment and make requests. Over the six month period, she developed context-bound words and also used offering and giving to communicate with her mother. At this time, Infant V3 initiated some routines and engaged in symbolic play activities. This dyad's well developed routines and the infant's responsiveness is reflected in the low percentage of CDs (7.3%). This level is similar to Dyads S2 and S3.

Sensory Intact Dyads. Mother S1 was similar to Mothers H3 and V3 in her use of RA. Similarly, she had well developed action-based routines and provided optimal prompts to elicit infant participation. This strategy is reflected in a higher percentage of action-based (76.5%) than reference-based (20.6%) routines. Like mothers of hearing impaired infants, Mother S1 used CDs to establish and maintain communication with a preverbal infant. Infant S1 was 14 months old at the first session. At this time, he used pointing, giving, vocalizations and a few imitative word approximations to comment and make requests. By the end of the study he engaged in symbolic play routines and used some recognizable context-bound words.

Mother S2 was similar to Mother H2 in her tendency to wait for her infant to initiate a routine. It is of interest to note that both Dyads H2 and S2

had a similar action-based to reference-based routine ratio. However, in contrast to Mother H2, Mother S2 used an almost equal percentage of RA (28%) to RI (26.7%). This contrast is not surprising given the communicative abilities and responsiveness of Infant S2. This infant was the most verbal--although one of the youngest--infants. She was 14 months at the beginning of the study. At the first session she used pointing, offering, showing, vocalizations and several word approximations to comment and make requests. She also engaged in elaborate play routines. During the latter sessions, this dyad engaged in varied and elaborate reference-based routines, whereas those of Dyad H2 remained fairly restricted and rigid.

Mother S3 tended to comment on and request information about her infant's activities. This tendency is reflected in a higher percentage of reference-based (75%) than action-based (25%) routines. Similarly, she used a higher percentage of RI (35.3%) to RA (12.7%). Infant S3 was 16 months old at the first session. At this time she used pointing, reaching, giving, vocalizations and word approximations to comment and make requests. During early sessions, this dyad engaged in symbolic play routines and developed flexible and elaborate reference-based routines.

This discussion of within group variations emphasizes the need for descriptive information and qualitative analyses to adequately identify the features and strategies of mother-infant communication. The following section will discuss variations in infant cognitive levels and in exchange-routine types, in order to ascertain qualitative differences within and among groups.

Qualitative Differences

Infant Cognitive Levels

As reported in the Methods section, measures of the infants' play, communicative and cognitive abilities were obtained to facilitate qualitative analyses. These data were used to acquire a composite profile of sensorimotor functioning for each infant. Table 8 displays the result of the pre- and post-taping assessments. The infants' cognitive abilities ranged from sensorimotor Stage III to Stage VI. Characteristics for each of these stages are listed in Appendix D (Dunst, 1978; 1980; Piaget, 1974; Westby, 1980). As shown in Table 8, at the beginning of the study, hearing impaired infants ranged from sensorimotor Stage III to Stage VI, the visually impaired infants ranged from sensorimotor Stage III to Stage V, and the sensory intact infants ranged from sensorimotor Stage III to Stage VI. By the end of the study, the hearing impaired infants ranged from sensorimotor Stage IV to Stage VI, the visually impaired infants ranged from sensorimotor Stage III to Stage VI, and the sensory intact infants ranged from sensorimotor Stage IV to Stage VI. However, modal stages of post-taping assessments for each infants show that the sensory intact group were at sensorimotor Stage VI, whereas the hearing impaired group ranged between Stages V and VI and the visually impaired group had the widest range of Stage IV to Stage VI. The infants' hearing or visual impairment seems to account for these across group differences. Table 8 shows a striking similarity across all dyads. There is a tendency for mothers to use a majority of imitation/game-based routines with infants (H1, V1) at sensorimotor stages III to IV, to engage mainly in action-based routines with infants (H3, S1) at the sensorimotor Stage V, and to increase the use of reference-based routines when infants (H2, V3, S2, S3) function on sensorimotor Stage VI. The particular case of infant V2 has been discussed

previously. Dyad V2 is an exception to the proposed hypothetical relationship between infant cognitive levels and exchange-routine types. The quality of this dyad's reference-based routines will be discussed in the following section.

Table 8

Range of Sensorimotor Stages for Each Infant and the Occurrence of Exchange-Routine Types.

	Sensorimotor Stages			Exchange-Routines		
Group	Pre-taping	Post-taping	Modal Range	I/GB	AB	RB
Hearing Impaired Infants						
H1	III-IV	IV-VI	IV-V	57.1%	28.6%	14.3%
H2	IV-VI	V-VI	V-VI	2.3%	48.8%	48.8%
H3	IV-VI	V-VI	V-VI	10.3%	66.7%	23.1%
Visually Impaired Infants						
V1	III-IV	III-V	III-IV	53.8%	46.2%	-
V2	III-V	IV-VI	IV-V	-	22.7%	77.1%
V3	IV-VI	V-VI	V-VI	-	57.5%	42.5%
Sensory Intact Infants						
S1	III-VI	IV-VI	V-VI	2.9%	76.5%	20.6%
S2	V-VI	VI	V-VI	2.2%	50%	47.8%
S3	V-VI	VI	V-VI	1.7%	25%	75%

Note. Modal Range = modes for pre- and post-taping assessments.

I/GB = Imitation/Game-Based

AB = Action-based

RB = Reference-based

- no occurrence

Exchange-Routine Types

The characteristics of the proposed exchange-routine types--imitation/game-based, action-based and reference-based--will be described through a series of examples. For each example, the context will be described and the observation will be discussed to clarify the proposed exchange-routine framework.

Imitation/game-based routines (Examples 1-4). These routines appear appropriate for infants at sensorimotor Stages III and IV. Mutual imitation provides a means of communication with a relatively immature partner. Examples 1 and 3 illustrated well defined routines with a hearing impaired and visually impaired infant respectively. Example 2 shows the need for maternal structure to organize the routine with a visually impaired infant. Example 4 demonstrates the use of an imitation-based routine to clarify and maintain a reference-based routine with a sensory intact infant.

EXAMPLE 1

Dyad H1, session #3, infant age 11 months (corrected for prematurity).

Context: Mother (M) and Infant (I) are looking at a toy lamb which is on the floor.

I: [da da dada]	
M: [da da dada]	(picks up toy and offers it to I)
I: [hæ hæ]	(puts mouth on toy)
M: [hæ ʌmːːʌ]	(kisses toy and offers it to I)
I: -	(kisses toy and laughs)
M: Yea [mːːːʌ] yea	(kisses toy and puts it down)

Comments: This mother imitates the infant's vocalizations and actions as a means to establish communication. She structures the routine by using a toy to elicit turn-taking. This hearing impaired infant is able to imitate

vocalizations and actions which are within her repertoire.

EXAMPLE 2

Dyad V1, session # 4, infant age 18 months.

Context: Mother (M) and Infant (I) are sitting on the sofa, I is on M's lap, facing her.

M:	Give mommy a hug.	(hugs I)
	Give mommy a big hug.	
	Gimme a kiss.	
	Gimme a kiss, kiss.	(leans closer to I's face)
	[m:::ʌ] gimme a kiss	(smacks lips)
	Say [m:::ʌ]	
I:	-	(finger in mouth, leans against M's chest)
M:	Say [ʌ:::]	(rising and falling intonation)
I:	[ʌ:::]	(looks up at M's face)
M:	[ʌ:::] say [ʌ:::]	
I:	[ʌ:::]	
M:	Say [ʌ:::]	(leans to right, gets a tissue)
I:	[ʌ:::]	
M:	Wipe your nose.	(puts tissue on I's nose)
	Nose	

Comments: These vocal play imitation-based routines were the most reciprocal, mutually enjoyable exchanges between this mother and her visually impaired infant. In this example, the mother does not provide adequate structure to enable her infant to predict the course of the routine. She tends to end or change routines abruptly.

EXAMPLE 3

Dyad V1, session # 3, infant age 17 months.

Context: Mother (M) and Infant (I) are sitting on the floor, facing each other. M is manipulating I's hand to place a block in a plastic bottle, I has been resisting the activity and has been banging the bottle on the floor.

I: [iˌjəu::: iˌjəu:::]

M: Singing while you playing? (guides I to drop block in bottle)

I: [i:::ʌ]

M: Whee! (" " " " " " ")

I: [i]

M: Boom! (" " " " " " ")

I: [i]

M: Whee! Whee! (" " " " " " ")

I: [i]

M: See how many ya got in here? Whee! (dumps blocks out of bottle)

Comments: This mother imitates her visually impaired infant's vocalizations and adds a vocal-play routine to block and bottle activity. The addition of objects provides a structure to a vocal play routine. This infant usually resisted physical guidance. However, she participates in this example because a least-liked strategy (physical guidance) is paired with a favorite activity (vocal imitation). Like Infant H1, this infant is able to participate in a vocal imitation/based routine of familiar sounds.

EXAMPLE 4

Dyad S1, session # 4, infant age 17 months.

Context: Mother (M) and Infant (I) are sitting on the floor. M is sitting to the side of I. On the floor is a toy kitty and a doll's bottle.

I: [ɡɪtə æ] (reaches for kitty and bottle)

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M: What're ya gonna do? Getting a bottle huh?
I: [æ təsɪ jə ɪjə ʌʃ jə] (holds kitty and bottle, turns them over in his lap)

M: Mmmm goodness.

I: [æ æ]

M: Huh?

I: [æ æ] (turns kitty over in lap)

M: What? (leans closer to I)

I: [æ]

M: Ah?

I: [jə]

M: What does that mean? Ah!

I: [æ ɬɪɬɪ]

M: Yea. (nods and sits back)

Comments: This mother has exhausted her informational strategies before her sensory intact infant could produce an intelligible response. She cannot decipher his vocalizations, so she maintains the exchange by means of fillers, prompts and imitative vocalizations. Finally, she accepts a label for kitty.

Action-based routines (Examples 5 & 6). These routines predominated exchanges with infants at sensorimotor Stages IV to V. Action-based routines provide gestural prompts which facilitate communication with a preverbal infant. Example 5 illustrates an action-based routine and an imitation/game based routine with a hearing impaired infant. Example 6 shows an action-based routine with a sensory intact infant at a similar sensorimotor level.

EXAMPLE 5

Dyad H3, session # 3, infant age 18 months.

Context: Mother (M) and Infant (I) are sitting on the floor side by side.

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M has dumped blocks out of a plastic bottle and is holding the empty bottle.

M:	Put'em back IN.	(signs IN over bottle)
	Put these in there.	(points to blocks and then to bottle)
	Can ya put'em in this?	(holds up bottle)
	Put all these in here.	(touches blocks and points to bottle)
I:	[nə]	(looks at M, reaches with block and holds it on mouth of bottle)
M:	Put it in there.	(points to bottle)
	Put'em in there.	(smiles, points to bottle)
I:	-	(drops block in bottle)
M:	Oh good boy!	
I:	-	(drops another block in bottle)
M:	Oh!	(jerks bottle back)
	Ah!	(offers bottle to I)
I:	-	(smiles and drops another block)
M:	Ah!	(jerks bottle away)
I:	[æ]	(joins in mother's vocalization, drops another block)
I:	[æ]	(drops in block, vocalizes as mother jerks bottle away and returns it)
I:	[æ]	(" " " " " ")
M:	Oh now take'em out.	

Comments: This example illustrates a variety of gestural prompts--pointing, showing, touching--which scaffold action-based routines. This mother expands the routine to include an imitation/game-based routine to maintain the infant's participation. She marks routine transitions with an evaluative

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statement "Oh good boy", or a request for action "Now take'em out". This clear cut structure enables the hearing impaired infant to anticipate and to participate in the routine sequence. In examples with hearing impaired infants, as is conventional in the literature (Siple, 1978) signs will be indicated by capital letters to distinguish them from spoken words. These mothers of hearing impaired infants signed and said the words indicated, simultaneously. Infants signed only or signed and vocalized simultaneously.

EXAMPLE 6

Dyad S1, session # 3, infant age 16 months.

Context: Mother (M) and Infant (I) are sitting on the floor facing each other. There are some wooden blocks on the floor.

M:	You know how to build with blocks huh?	(stacks blocks)
I:	[ɜwandəɹɪɹu]	(points to stack)
M:	Yes, ya wanna build some too?	
	Put it on top of these.	(points to block on floor)
	Put it on top.	
I:	-	(places block on stack)
M:	That's right, that's right.	(claps)
I:	-	(smiles and claps)

Comments: This mother provides optimal structure for an action-based routine. She introduces the activity by demonstrating the action and then invites her sensory intact infant to join in. She uses pointing as a prompt to elicit the infant's response and marks the end of the routine with an evaluative statement and by clapping. Action-based routines do not require the infant to respond vocally. The infant's action is taken as a turn in the routine.

Reference-based routines (Examples 7-15). These routines were used in all

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but one dyad (V1). The prevalence of this routine suggests that mothers strive toward verbal communication with their infants. The length and complexity of these routines varied among dyads according to the infant's ability to request or supply information. The most developed reference-based routines were found with infants functioning on sensorimotor Stage VI. This variation in reference-based routines is the basis of a tentative hierarchy. The proposed hierarchy will be described in order to trace the development of reference-based routines across infants.

1. Initial reference-based routines are illustrated in Examples 7 and 8 with a visually impaired and hearing impaired infant respectively. In these routines the infant cannot and is not expected to supply information. The mother's request for information appears rhetorical. She answers her own question without waiting for an infant response. The main objective seems to be infant exposure to a question-answer format.

2. Early reference-based routines are illustrated in Example 9 with a hearing impaired infant, in Example 10 with a sensory intact infant and in Example 11 with a visually impaired infant. In these examples, infants have a single response repertoire. They cannot offer another response to "fit" the maternal request for information. In addition, mothers tend to repeat the same request if the infant does not supply an acceptable response. The limited response repertoire of both partners contribute the rigid and repetitious quality of early reference-based routines.

3. Middle reference-based routines are illustrated in Example 12 with a hearing impaired infant and in Example 13 with a visually impaired infant. In these routines, infants are able to change responses if their mothers do not accept the original offering. However, their response repertoire is still fairly limited.

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4. Late reference-based routines are illustrated in Examples 14 and 15 with sensory intact infants. These routines are varied, flexible and productive. This level was observed only with the two most verbal and fully Stage VI sensory intact infants.

An additional strategy of switching routines (Examples 16, 17 & 18) was observed in instances where the infant remained unresponsive to the mother's original routine format. In Examples 16 and 17 mothers discard their original format and switch to another in order to elicit their hearing impaired or visually impaired infant's response. In contrast, Example 18 illustrates a routine switch initated by a sensory intact infant.

EXAMPLE 7

Dyad V2, session # 1, infant age 15 months (corrected for prematurity).

Context: Mother (M) and Infant (I) are looking at a book. M is sitting on the floor, I is on her lap.

M: What's kitty say?

Meow.

Cow, what does a cow say?

Say moo.

I: - (grabs book and looks at M)

M: Yea, you like that huh?

Comments: This mother's requests for information appear rhetorical. In this initial reference-based routine she supplies the answer without prompting her infant to respond. Book-reading was a favorite activity for this dyad. This preference is surprising given the infant's visual impairment and preverbal communication level. However, book-reading provides an essential structure which encourages mother-infant communication. The infant's behavior is interpreted as a turn in the routine. This mother usually selects a book

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with animals as if to encourage infant vocalization. This Dyad's reference-based routines developed along with the infant's response repertoire over the six months. (See Example 11).

EXAMPLE 8

Dyad H2, session # 4, infant age 17 months.

Context: Infant (I) is sitting at a table looking at a book. Mother (M) is seated in a nearby chair.

I:	[m:::]	(looks at book, looks at M)
M:	What do ya SEE?	
I:	[^^]	(pats chair beside her)
M:	Sit here.	
	MOMMY SIT DOWN.	(signs and sits beside I)
	Turn the book right.	(turns book)
	RABBIT, yea.	(signs on self)
	RABBIT.	(signs in I)
	What's that?	(points and taps picture)
	BEAR.	(signs on I)

Comments: This example illustrates the rhetorical question "What's that?" which occur in initial reference-based routines. The question "What do you see?" is used frequently with hearing impaired infants. This question form is derived from educational programs for hearing impaired children. This mother uses common strategies with her hearing impaired infant: signing on the infant's body, and "putting signs in the infant's hands" by verbalizing the infant's gestural request. In this study, all three mothers of hearing impaired infants displayed creativity and flexibility in use of their limited sign repertoire. They signed on objects and on the infant's body to ensure the infant's reception of the sign. These strategies have been used by deaf

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parents of hearing and hearing impaired infants (Maestas Y Moores, 1980). It seems that hearing mothers of hearing impaired infants develop these strategies as well. These mothers reported that these sign strategies evolved naturally through efforts to communicate with their infants.

EXAMPLE 9

Dyad H2, session # 1, infant age 14 months.

Context: Mother (M) is sitting on the sofa. Infant (I) is standing nearby and removes a doll (D) from the toy basket which is on the floor.

M: Is that your BABY, BABY? (signs BABY)

I: (BABY) (signs BABY, offer D to M)

M: Yea, PRETTY, yea. (signs PRETTY, takes D)

I: (BABY) (looks at M and signs)

M: BABY, yea, BABY. (signs holding D)

I: (BABY) (looks at M and signs)

Comments: This example illustrates the repetitive quality of early reference-based routines. This hearing-impaired infant's single response repertoire and her mother's limited sign vocabulary inhibit expansion of this routine. This mother's tendency to sign and repeat the last word of a sentence is a common feature of novice signers using the simultaneous method (speech and sign). This disfluency may serve as practice for the signer as well as to highlight a sign for the receiver.

EXAMPLE 10

Dyad S1, session # 4, infant age 17 months.

Context: Mother (M) and Infant (I) are sitting beside each other on the floor. I reaches for a toy kitty.

I: [ɔsɪ] (picks up kitty)

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M: Was that a kitty cat huh?

I: [he] (holds kitty)

M: What is it?

I: [ɛɪtɪ]

M: Is it a kitty cat?

I: - (discards kitty)

Comments: In this early reference-based routine, the mother uses the strategy of supplying the answer in her question. However, her sensory intact infant does not respond to a question which does not really request information. He does respond to a real request for information "What is it?". This observation may have implications for communication programs, in terms of question-answer formats which motivate student response.

EXAMPLE 11

Dyad V2, session # 6, infant age 20 months.

Context: Mother (M) and Infant (I) are looking at a book. M is sitting on the floor, I is in her lap.

I: [bæ bæ bæ bæ] (grabs book, pulls it to face)

M: Where, where's the ball?

I: [bæ]

M: Where?

I: [bæ]

M: What's this? (taps page)

I: [bæ]

M: Boat.

What's the duck say? (taps page)

There's a duck, what's the duck say?

I: [kæ]

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M: Good. There's trees (points to picture)
and fish.

I: [bəɹ]

M: There's a beach ball. (points)
There's a teddy bear.

I: [ɹə bəɹ]

Comments: This mother fits her visually impaired infant's limited response repertoire into an early reference-based routine. In contrast, to their initial routine in Example 7, she now expects and waits for the infant to respond to her question. She interprets the infant's vocalization and asks "Where's the ball?". But the infant does not respond appropriately.

EXAMPLE 12

Dyad H3, session # 6, infant age 21 months.

Context: Infant (I) is lying on the floor, facing a toy kitty (K). Mother (M) is standing beside him.

I:	[ɛ ɑ]	(looks at M)
M:	Is a KITTY.	(signs CAT)
I:	[ʌ] (DOG)	(vocalizes, touches K, looks at M, signs DOG)
M:	NO, it's a KITTY.	(signs NO and CAT)
I:	(KITTY)	(looks at K, imitates M's sign)

Comments: This example demonstrates a somewhat expanded infant response repertoire which marks a middle reference-based routine. This hearing impaired infant can request information, comment and acknowledge his mother's response. This mother signs and says words indicated by capital letters. The infant signs only.

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EXAMPLE 13

Dyad V3, session # 3, infant age 17 months.

Context: Mother (M) and Infant (I) are sitting on the floor. M takes a pair of child's sunglasses out of the toy basket.

M: What's this? Look. (holds glasses close to I's face)

I: [kɛɪk]

M: What's zat? (puts glasses on I's face)

I: [kɪ kɪ kɪ] (touches glasses)

M: Peek-a-boo? That's glasses.

I: [gəkɪ] (holds glasses)

M: Mmhm

I: [ənəɪ] (turns to M and offers her glasses)

M: No, it's not for mommy to put on.

It's a toy, it's a toy.

I: [tɔɪ]

Comments: This example illustrates the tendency of mothers to remind their partially sighted infants to use their residual vision. In this middle reference-based routine, the visually impaired infant has a varied response repertoire. She can change her original response to an intelligible one, initiate a request for action and produce verbal approximations of her mother's labels.

EXAMPLE 14

Dyad S3, session # 4, infant age 19 months.

Context: Mother (M) and Infant (I) are sitting on the floor. M is holding a battery-operated kitty (K).

I: [ɛ:::] (reaches and touches K)

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M: Hi kitty. (offers K to I)

I: [dɛ:::jɛ] (holds K and points to button)

M: What do ya wanna do?

I: [jɛ jɛ] (offers K to M)

M: What do you want mommy to do? (holds K)

I: [ə wə də wɔk] (points to K, looks at M, nods)

M: You want him to walk?

I: [jə]

M: There, he likes your baby I think. (turns K on, puts it on floor near doll)

I: [jə]

M: And I think he's thirsty. (pats K, puts toy cup to K's and then to I's mouth)

I: (laughs)

M: What do kitty's drink?

I: [kʌmɒ] (takes cup, puts it on K's mouth, points)

M: Is he coming?

I: [jə]

M: He wants to see you.

Comments: This sensory intact infant has a varied and flexible response repertoire which characterizes a late reference-based routine. She can make requests, comment and acknowledge maternal statements. This mother uses questions to confirm and acknowledge infant comments and requests. She adds props (doll, cup) to elicit infant comments and to expand the routine.

EXAMPLE 15

Dyad S2, session # 4, infant age 18 months.

Context: Mother (M) and Infant (I) are sitting on the floor, side by side.

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M has a book in her lap.

M: What's this? (points to picture)

I: [ə bə] (looks at M)

M: One balloon, one balloon.

How many cats are there?

one,_____

I: [tu]

M: ..What's this baby doing?(points to picture)

I: [ɚ kaɪŋ] (looks at picture)

M: She's crying.

I: [dɑ bebɪ dɑ bebɪ] (looks around and picks up doll)

M: Is that baby crying too?

I: [mɑlɪ] (holds doll)

M: Molly's crying?

I: [nə] (looks at book)

Comments: In this example of a late reference-based routine, the sensory intact infant is able to expand the routine as well as answer maternal informational requests. This mother acknowledges and confirms the infant's comments by means of questions. She also uses a partial completion strategy as a prompt to elicit infant response.

EXAMPLE 16

Dyad H3, session # 1, infant age 16 months.

Context: Mother (M) is sitting on the floor. The infant (I) is standing a few feet away. M puts some nesting cups on her fingers. I runs over and looks at M's hand.

M: What is zat? (shows cups to I)

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	Look.	(points to cup)
	What is zat huh?	(points)
I:	-	(shakes hands)
M:	Whazis? What is this?	(offers cup to I)
I:	-	(takes cup)
M:	Put this one in here.	(puts one cup in another)

Comment: This mother first attempts to engage her hearing impaired infant in a reference-based routine. She points to the outline of an animal on the cups. After three unsuccessful attempts to elicit infant response, she switches to an action-based routine. It is not clear if the infant's hand movements are a gesture for "want", his mother does not interpret this behavior.

EXAMPLE 17

Dyad V2, session # 3, infant age 17 months.

Context: Mother (M) and Infant (I) are sitting on the floor. A battery-operated kitty (K) is in front of them.

M:	Do you want to play with the kitty?	
	Kitty.	(picks up K and shows I)
I:	[mə]	
M:	What does kitty say?	(holds K)
I:	[me]	
M:	Meow.	(stands K on floor)
	Can pet her, nice kitty.	(pats K)
	Pet her.	(pats K with I's hand)
I:	[mə]	
M:	Can give her a kiss.	(picks up K)
	Wanna give her a kiss?	(kisses K)

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give her a kiss, give her a kiss. (offers K to I)

I: - (moves off M's lap and picks up another toy)

Comments: This mother begins with a reference-based routine but switches to an action-based routine after she has exhausted her visually impaired infant's limited response repertoire.

EXAMPLE 18

Dyad S2, session # 1, infant age 14 months.

Context: Mother (M) is sitting on the floor. Infant (I) is standing in front of her. M is stacking some plastic cups.

M: Wanna put this one on top? (offers cup to I)

I: [ʌʌʌ] (touches cup and looks at M)

M: What's that? A hippopotamus. (looks at animal outline on cup)

What's this? (shows I another cup)

I: [wɔwə] (touches cup)

M: Walrus.

What's this? (shows I another cup)

I: [ɬɪɬɪ] (looks at cup)

M: That's a lion. What's a lion say?

I: - (looks at M)

M: Roar!

What's this? (shows I another cup)

I: [ɰʊɰv] (looks at cup)

M: Doggy.

What's this one? (shows I another cup)

I: [ɬɪɬɪ] (looks at cup and then at M)

M: Kitty.

Can you put the kitty one on top of the doggy like that? (points to cup and then stacks the cups)

Comments: In this final example, the mother begins with an action-based format but her sensory intact infant switches to a reference-based routine. This infant was the most verbal of the infant sample. She was more interested in naming the animal outlines than in stacking the cups. Her mother confirms and acknowledges her verbal approximations and structures the routine in a predictable way. After several rounds, this mother reintroduces the action-based format by referring to the animal labels.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Mothers in this study seemed in tune with their infant's communicative abilities and cognitive levels. For the most part, they used a variety of strategies to engage their infants in communicative exchange. These mothers were a self-selected group who had volunteered to participate in a research study. To a certain extent, their behaviors must have been influenced by the presence of an observer and camera. However, findings support the following conclusions:

1. Differences in the frequency of certain utterance types between mothers of sensory intact infants and mothers of hearing impaired infants reflect the impact of an infant's hearing loss and the elementary sign language level of the hearing impaired dyads.

2. Similarities in the frequency of certain utterance types between mothers of visually impaired infants and mothers of hearing impaired infants reflect maternal strategies in communication with a preverbal partner.

3. Similarities in the frequency of certain utterance types between mothers of visually impaired infants and mothers of sensory intact infants reflect an emphasis on functional use of the visually impaired infants' residual vision.

4. Analysis of exchange-routine types support the findings for single utterance types among the three dyadic groups.

5. In contrast to single maternal utterances, an examination of exchange-routine types provides a richer and more accurate description of mother-infant communication, as well as a means to evaluate the infant's

participation.

6. The majority of mother-infant communication in play situations may be classified as one of three types of exchange- routines: imitation/game-based, action-based or reference-based.

7. There is a tendency for imitation/game-based routines to be used mainly with infants at sensorimotor Stages III and IV.

8. There is a tendency for action-based routines to be used mainly with infants at sensorimotor Stages IV and V.

9. There is a tendency for reference-based routines to be used mainly with infants at sensorimotor Stages V and VI.

Characteristics of Exchange-Routine Types

Imitation/game-based routines. Based on study findings, these routines may be characterized by two basic formats: infant-initiated or "you do-I do" and mother-initiated "I do-you do". Formats are identified from the mother's perspective because she organizes and maintains the routine. Table 9 illustrates a three turn exchange for each of these formats:

1. You do-I do". Mothers recruit the infant's participation and maintain a routine by imitating the infant's vocalizations and/or actions. They set the pace for the routine by taking a turn at an opportune moment, such as, when the infant pauses. The nature of a third turn will depend on the infant's response to maternal imitation of a familiar behavior. Objects may be incorporated with vocal imitation routines, and may provide additional structure to define routine sequence. (See Examples 1 and 3 in the Findings section). The "you do-I do" format may be used also to elicit infant participation in an activity, or to clarify other routines. (See Examples 3 and 4 in the Findings section).

2. "I do-you do". Mothers initiate this routine with a vocalization and/or action which is familiar to the infant. This format is more difficult than "you do-I do" because the infant must attend to the maternal model and approximate it. The third turn in this format is filled by maternal response to infant imitation of the initiating behavior.

Action-based routines. Based on study findings, these routines may be characterized by two basic formats: mother-initiated or "I request action - you do", and infant-initiated "You request action - I do". Table 10 illustrates a three turn exchange for each format:

1. "I request action - you do". Mothers initiate an action-based routine by requesting, suggesting, inviting or demonstrating an action. Optimal structure is provided through an elaborate system of maternal prompts. (See Examples 5 and 6 in the Findings section). As shown in Table 10, maternal request for action may be composed of: (a) a demonstration of an action and a verbal request, (b) an invitation for infant participation, (c) a series of gestural prompts to shape the infant's response, and (d) physical guidance if the infant fails to respond appropriately. This system of prompts is a well recognized teaching strategy in special education (Adams, 1982). However, the mothers in this study developed these strategies naturally through efforts to communicate with their infants.

2. "You request action - I do". As shown in Table 10, the infant initiates a request through vocalizations and/or gestures. The length of action-based routines will vary according to the responses of both partners. However, maternal prompts provide a valuable scaffold which enables the infant to take a turn in action-based routines.

Table 9

Two Basic Formats of Imitation/Game-Based Routines

Infant-Initiated "You do-I do"		
Infant's Act →	Mother's Response →	Infant's Response
-action	-repeats infant's act	-repeats original act
-vocalization	-expands infant's act	-approximates mother's response
	-comments on infant's act	-changes routine
	-requests	

Mother-Initiated "I do-you do"		
Mother's Act →	Infant's Response →	Mother's Response
-action	-approximates mother's act	-repeats infant's response
-vocalization		-evaluates infant's response
-verbalization		-expands infant's response
		-changes routine

Note. Acts and responses may occur in any combination.

Table 10
Two Basic Formats of Action-Based Routines

Mother's Act →	Infant's Response →	Mother's Response
Mother-Initiated "I request action-you do"		
-request action (RA)[a]	-complies with mother's RA	-evaluates infant's response
	-request action (RA)	-complies with infant's RA
		-repeats original RA
		-changes routine
Infant-Initiated "You request action-I do"		
Infant's Act →	**Mother's Response →**	**Infant's Response**
-request action (RA)	-complies with infant's RA	-complies with mother's RA
	-comments	-answers mother's RI
	-request information (RI)	-repeats original RA
	-request action (RA)	-changes routine

Note. Responses may occur in any combination.

[a]Mother's means of RA may include verbalization, gestures, demonstration and physical guidance.

Table 11
Two Basic Formats for Reference-Based Routines

Mother-Initiated "I ask-you tell"

Mother's Act ⟶	Infant's Response ⟶	Mother's Response
-request information (RI)	-answers RI	-evaluates infant's response
-label	-repeats mother's act	-repeats infant's response
-describe	-comments	-continues routine
		-changes routine

Infant-Initiated "You ask-I tell"

Infant's Act ⟶	Mother's Response ⟶	Infant's Response
-request information (RI)	-answers RI	-repeats original act
-comments	-repeats infant's comment	-repeats mother's response
	-expands infant's comment	-answers RI
	-evaluates infant's comment	-changes routine
	-request information (RI)	

Note. Acts and responses may occur in any combination.

Reference-based routines. Of the three exchange-routine types, reference-based routines encourage a verbal response and places the heaviest cognitive load on the infant. To respond to the question "What's that?", the infant must: (a) attend to the object in question, (b) differentiate it from other objects, (c) identify it as belonging to a class of objects, and (d) produce a recognizable label. In this study, mothers used rhetorical questions and questions which contained the label as scaffolds for infant participation in reference-based routines. (See Examples 7,8,9 and 10 in the Findings section). Based on study findings reference-based routines may be characterized by two basic formats: mother initiated or "I ask - you tell" and infant initiated or "you ask-I tell". Table 11 illustrates a three-turn exchange for the two basic formats:

1. "I ask - you tell". Mother initiates this routine with informational requests, labels or descriptions. The infant's response may be one of several acts which fulfill a turn. The nature of the third turn will depend on the mother's agenda for the routine.

2. "You ask - I tell". The infant initiates this routine with informational requests or comments using gestures and/or vocalizations, and/or verbal approximations. Maternal response may be one of several acts as shown in Table 11. The third turn is determined by the infant's ability to maintain or change the routine.

Recommendations

This study was an initial step in establishing a data base from which to develop intervention procedures to optimize parental communication with sensory impaired infants. Given the limitations of the study, the proposed framework of exchange-routines is tentative at best. However, the following recommendations are based on study findings which are consistent with the literature and the theoretical basis of the study.

It is recommended that the proposed exchange-routine framework be used to observe mother communication with sensory impaired infants. These observations will determine: (a) types of routines used, (b) usefulness of a particular routine for an individual infant, (c) strategies used to maintain and expand the routine, (d) strategies needed to maintain the routine, and (e) idiosyncratic dyadic strategies. In addition, observations will provide a basis for further modification or expansion and/or validation of the proposed framework.

It is recommended that imitation/game-base routines be used as an initial step in communicating with the unresponsive infant. The infant's original vocalization and/or action should be expanded to incorporate new actions, objects, vocalizations and words. An expansion of the imitation-based routine will discourage the development of "parrot-like", meaningless exchanges. In addition, object use will provide a definite structure for imitation/game-based routines and will facilitate transition to action-based routines.

It is recommended that action-based routines be used to facilitate communication with a preverbal infant. These routines require no verbal behavior but they elicit turn-taking and joint reference behaviors. A scaffold of maternal prompts should be used to elicit infant response.

Certain routines, for example, body part identification and symbolic play activities, may be used to facilitate the infant's transition to reference-based routines. Identification of body parts involves both imitation and action. The informational request "Where's your nose?", is really a request for action "Touch your nose"; or an attempt to elicit imitation if the mother touches her nose while asking the question. Similarly, doll play routines use imitation and action while providing opportunity for reference. Symbolic play routines may be particularly useful in expanding reference-based routines.

The findings of this study provide a tentative framework by which to examine maternal communication with sensory impaired infants. Further investigation is needed to replicate findings, and to test the validity of the three exchange-routines. Additional findings would modify, elaborate or verify features of each type of exchange-routine as reported in this study. Additional research is necessary to test the hypothesized relationship between types of exchange-routines and sensorimotor stages. This study, like all research, is a compromise between research objectives and available resources. This study objectives were accomplished. However, findings would have been strengthened by a larger sample, more frequent observations, varied observations and a longer observation period. It would have been valuable to have observed the sensory intact infants from a younger age to determine the nature of their imitation/game-based routines. Similarly, extended observation of the sensory impaired infants to an older age could determine the quality of their late reference-based routines. In addition, an extended observation period would determine the course of exchange-routines with an infant who remains preverbal. Efforts should be made to test the usefulness of the exchange-routine framework for multihandicapped sensory impaired infants and children.

Given study limitations, findings describe optimal situations in which mother and infant appear motivated to communicate. Study findings demonstrate that mothers of sensory impaired infants develop adaptive strategies to fit the infant's sensory status, communicative and cognitive abilities. Mothers in this study seem to fine tune exchange-routines as a means of communicating with an immature partner. These routines seem to be enjoyable, repetitive and predictable. Such features encourage joint reference, facilitate turn-taking and promote infant anticipation of a sequence of events. The literature suggests that communication develops through enjoyable reciprocal interactions with significant others. If this is so, then well developed exchange-routines represent an invaluable means of establishing communication with a preverbal infant. Early intervention programs should therefore focus on developing individualized exchange-routines in order to optimize parent-infant communication.

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APPENDIX A

Sets of Toys

1. Manipulatives: bristle blocks, popbeads, nesting cups, blocks and plastic bottle.

2. Sound toys: tambourine, zylophone, drum, maracas, cardboard accordian, rubber squeeze toys.

3. Wind-ups, battery-operated or pull toys: jack-in-the-box, kitty, lamb, racoon, bee.

4. Symbolic play: real plastic bowl, wooden spoon, child's pair of sunglasses, string of wooden beads.

Plastic toy telephone, 3" doll and 9" doll.

Clear plastic zippered bag of toy cups, saucers, spoons, forks, pitcher.

Clear plastic zippered bag of toy comb, brush, doll's bottle, washcloth and plastic bed and bathtub.

Clear plastic zippered bag of doll's chairs and table.

Clear plastic zippered bag of domestic and farm animals.

5. Books: "Things to See", "The Touch Me Book", "Pat the Bunny", "The Counting Book", books about animals.

Two toys from each group were made available at each play session.

APPENDIX B

Coding Categories for Single Maternal Utterances

1. Request for action (RA): attempts to elicit a behavioral response from the infant, including suggestions and invitations. For example, "Let's play with the dolly", "Give mommy a kiss", "Wanna sit down?", "Gotta blow in it".

2. Request for information (RI): attempts to elicit an informational response from the infant. For example, "What's that?", "Where are you going?", "What do you see?"

3. Label (L): single word utterances or utterances which name people, objects or actions. For example, "Kitty, that's a kitty".

4. Description (D): utterances which describe tangible characteristics, actions, appearance of objects or people in the immediate vicinity. For example, "That's a little kitty", "He's running", "You're feeding the baby".

5. Conversational Devices (CD): utterances which serve to establish or maintain contact with the infant. These include the infant's name, greetings and other conventional social expressions "Thank you", prompts "huh?', fillers "mm", acknowledgements "Yea", vocal accompaniments to action "Here you go" and exclamations "Oops".

6. Elicited Imitation (EI): attempts to elicit a vocal or verbal imitation from the infant. For example, "Say good girl".

7. Repetition (R): Maternal verbalization of infant approximation within the first 5 words of the next speaking turn or an exact imitation of infant vocalization.

8. Social Play (SP): familiar games such as peek-a-boo, making noises and vocal play to engage the infant.

9. Performative play (PP): reading from a book or reciting a nursery rhyme.

10. Request for permission (RP): utterances which seek the infant's permission for an action, such as, "Can mommy have a dolly"?

11. Referential Correction (RC): utterances which correct the infant's label or description, such as, "That's not a doggy, that's a kitty".

12. Proscriptive (P): attempts to inhibit infant behaviors. For example "Don't put that in your mouth", "Quiet", "Stop pulling on your hearing aid".

13. Statements: utterances which evaluate people, actions or objects, such as "That's right". Utterances which interpret infant feelings, for example, "You like that toy", "You're tired of playing". Utterances which express maternal feelings, such as, "Mommy likes spaghetti".

14. Displaced Speech (DS): utterances which refer to events, people or objects which are not present. For example "We have some of these at Gary's house", "You went on the slide at Gymboree".

15. Other (O): any utterance which cannot be classified in any of the other categories.

APPENDIX C

Criteria for Classifying Maternal Utterances into Exchange-Routines

Segments of the transcripts were isolated into cohesive segments based on involvement with one object or activity. Whenever possible, utterances were used as boundary markers to isolate routines. For example, RI ("What's this?") and RA ("Put this block here") usually marked beginning of routines, whereas evaluative statements ("that's right, good girl") marked the end.

Imitation/game-based routines

Segments involving one or more maternal utterance which imitated infant behavior or attempted to elicit infant imitation of maternal behavior. Single unsuccessful attempts were not counted.

Action-based routines

Segments involving one or more maternal utterances which attempted to elicit a behavioral response from the infant. Single unsuccessful attempts were not counted.

Reference-based routines

Segments involving one or more maternal utterances which labelled, described or elicited an informational response from the infant. Single unsuccessful attempts were not counted.

APPENDIX D

Sample Characteristics of Sensorimotor Stages

Stage III

The infant at this stage:

-uses simple motor acts e.g. banging, hitting

-repeats simple motor acts to keep a toy activated

-rotates objects to examine them

-searches briefly for removed or absent objects

-vocalizes in response to babbling and familiar sounds

-imitates simple familiar gestures

-approximates adult action

-enjoys games e.g. peek-a-boo

-performs part of familiar game in an attempt to reinstate it

-responds to name

Stage IV

The infant at this stage:

-pushes an obstruction aside to obtain an object

-uses locomotion to get object

-pulls string to obtain toy

-imitates babbling and familiar words

-approximates unfamiliar words and sounds

-approximates unfamiliar gestures which can see self perform (visible)

-imitates unfamiliar visible gestures

-protests object being taken away

-participates in familiar games

-shakes head for no, waves bye-bye, extends arms to be picked up

-gives toy to adult upon request

-knows own name

Stage V

The infant at this stage:

-pulls string along a horizontal surface to obtain attached toy

-invents a way to put necklace into container

-first attempts to stack a solid ring on a stick, then avoids

-approximates novel words

-imitates 2 novel words

-attempts to imitate unfamiliar gestures which cannot see self perform (invisible)

-imitates 1-3 invisible gestures using objects

-gives and shows objects to others as a means to initiate interaction

-participates in a ball-rolling game

-gives toy to adult to have it activated

-gives book to adult to request "story time"

Stage VI

The infant at this stage:

-shows foresight in placing necklace into container and by avoiding solid ring

-uses a stick to remove toy from a clear and an opaque tube

-imitates at least 4 new words

-imitates invisible gestures without objects

-shows deferred imitation

-imitates complex series of familiar and unfamiliar sounds and actions

-spontaneously names persons, actions and objects

-engages in symbolic play e.g. feeds self, doll and mother

-combines two toys e.g. puts spoon in cup and stirs

-uses an object as a signifier for another e.g. pretending a stick is a spoon